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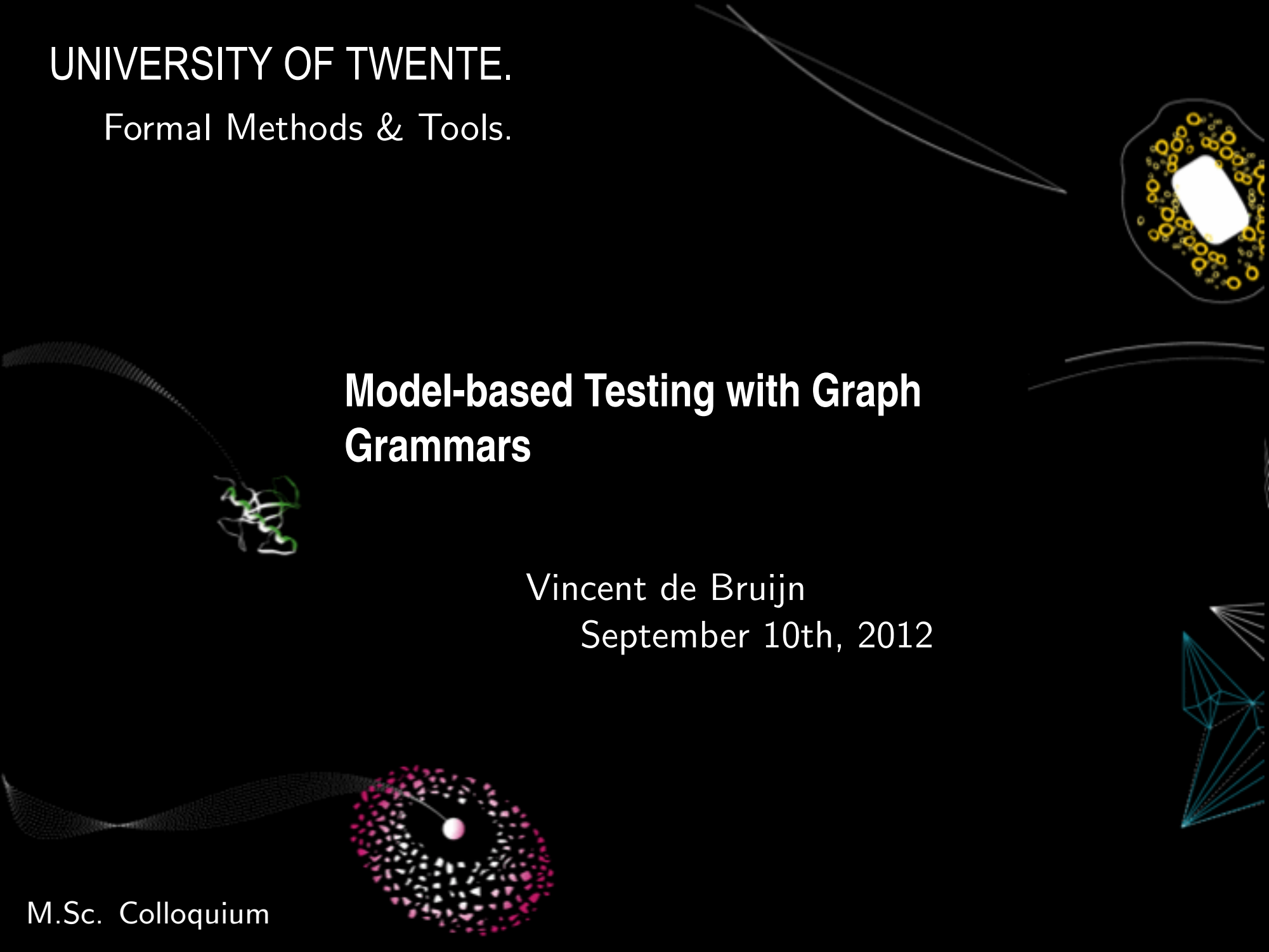
Formal Methods & Tools.



Model-based Testing with Graph Grammars

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M.Sc. Colloquium

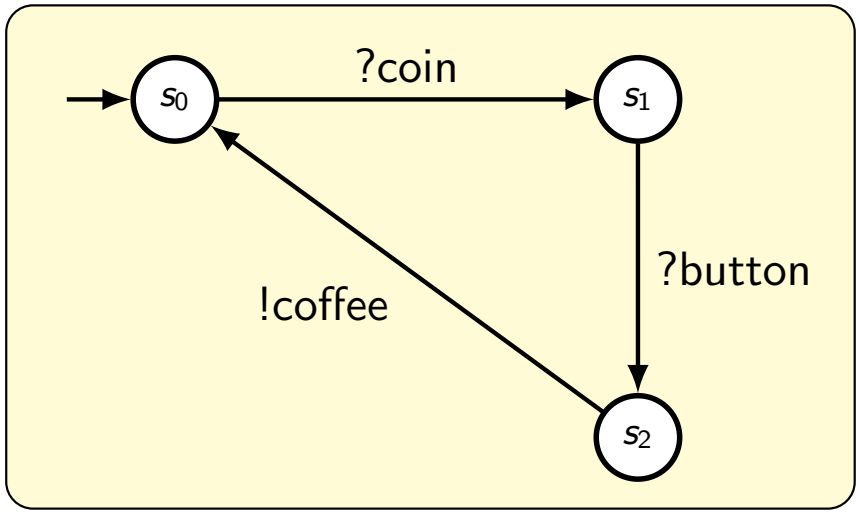
Model-based Testing (1/3)

- Why testing?
  - List of requirements
  - Test if implementation satisfies requirements
- Creating tests manually:
  - Error-prone
  - Time intensive
- Solution
  - Create model from the requirements
  - Generate tests automatically using model

Model-based Testing (2/3)

Model

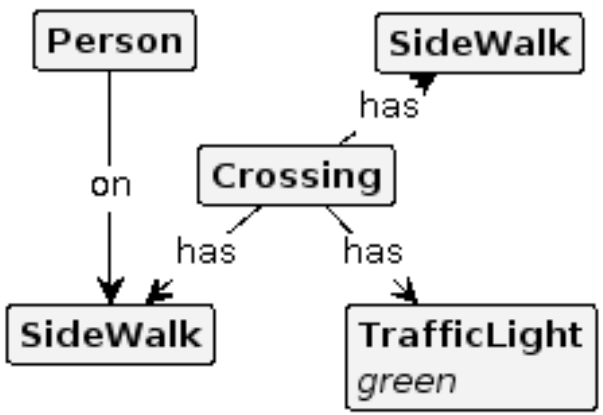
- An abstract representation of the behavior of a system



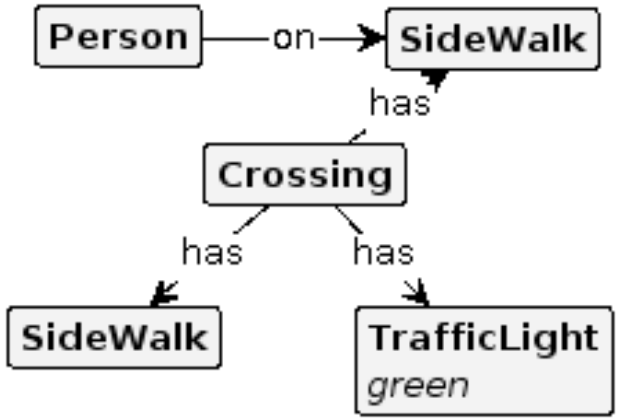
Model-based Testing (3/3)

1. Take possible stimulus from model
2. Apply stimulus to SUT
3. Observe response(s)
4. Check if according to model
5. Notify tester whether test passed or failed
6. Repeat

Graph Grammars (1/2)



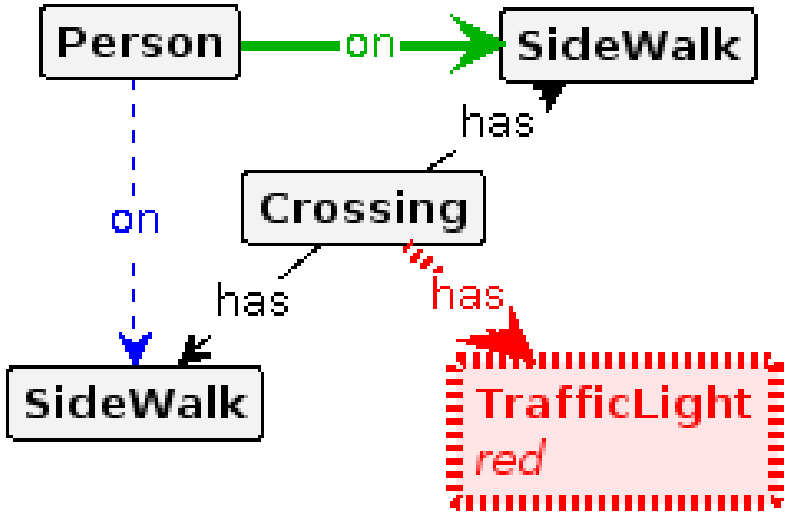
before



after

- Graphs represent system states
- Graph rules express possible changes to graph
- All possible changes make a *Graph Transition System*

Graph Grammars (2/2)



- Black and blue parts have to be present in graph
- Red parts may not be present in graph
- Blue is erased from graph
- Green is added to graph

Tools

- Axini Test Manager (ATM)
- GRaphs for Object-Oriented VErification (GROOVE)

Research Goals

- Goals
  - Use GROOVE and ATM to create model-based testing tool with Graph Grammars
  - Validate this tool using case studies
- Motivation
  - Graphs are well-known and often used to represent system states
  - Rules are useful for describing computations

Inhoudsopgave

1. Setup
2. From Graph Grammar to STS
3. Validation
4. Conclusion

Contents

1 Setup

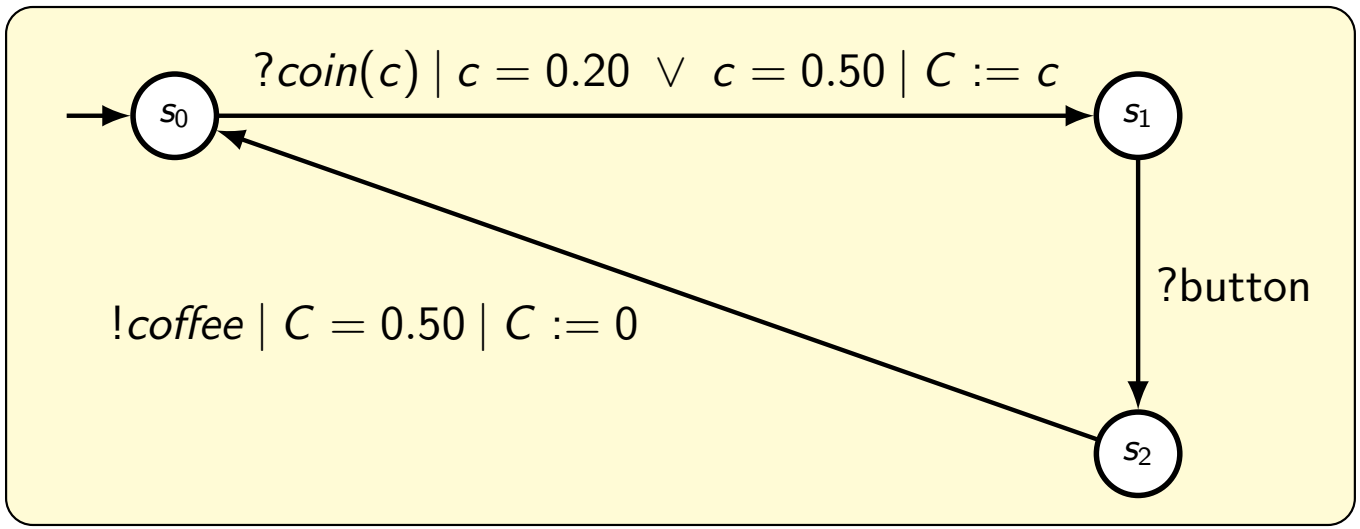
2 From Graph Grammar to STS

3 Validation

4 Conclusion

Setup (1/2)

- Graphs for humans, transition systems for computers
- ATM uses *Symbolic Transition Systems*



Setup (2/2)

- The tool:
  1. creates STS from the GG in GROOVE
  2. sends STS to ATM
  3. does model-based testing in ATM
- Step number 1 is main part of this research.

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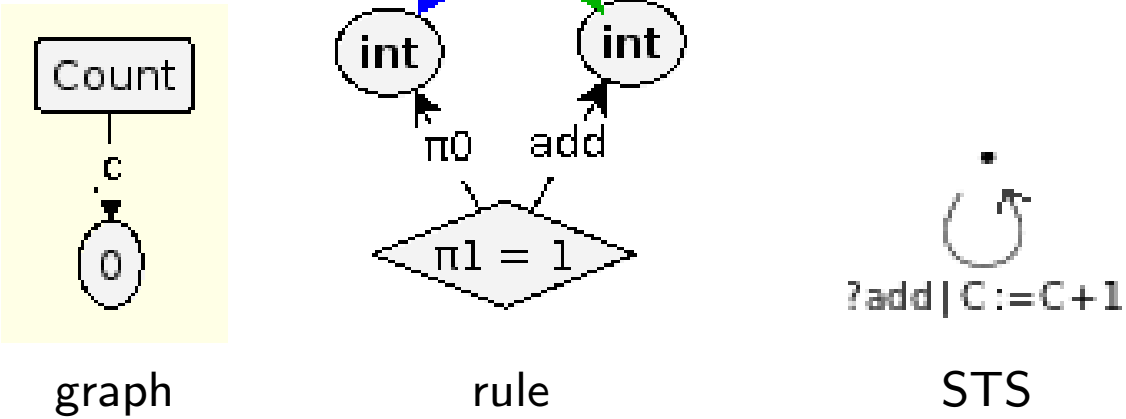
Algorithm

1. Create variables from data values
2. Explore GTS disregarding data values
3. Parse guards and updates from rules



graph rule STS

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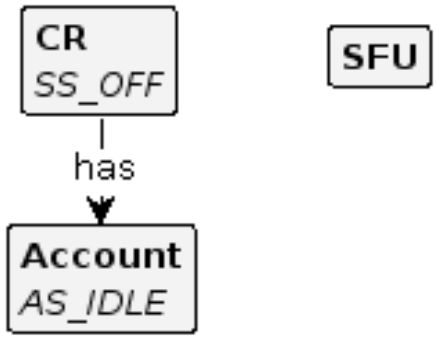
Model Examples

- 4 small examples used:
  1. a boardgame
  2. a puzzle
  3. a reservation system
  4. a bar tab system

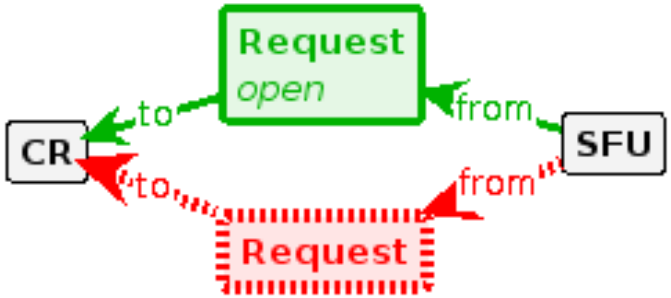
Case study (1/2)

- Self-checkout register

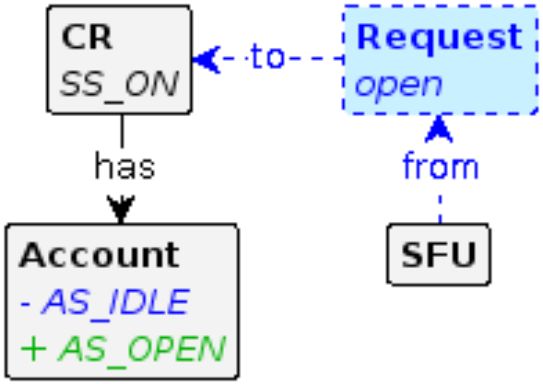
Case study (2/2)



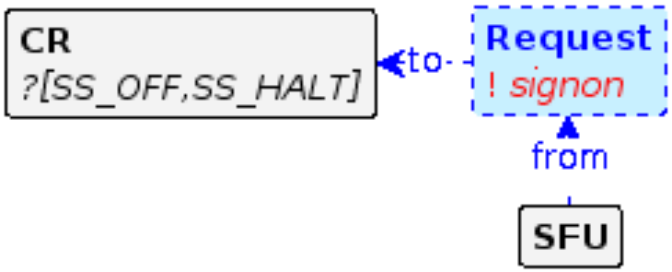
graph



request



response



error

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Conclusion

- Created a tool for model-based testing with Graph Grammars
- Transformation needs to be extended: complex data structures
- Modelling behavior with GGs is effective